Claims

[c1]   1. A method for building a calibration lookup table, the method comprising:
initializing said lookup table including initializing a Kalman filter corresponding
to said lookup table wherein said Kalman filter includes state estimates
corresponding to table element values in said lookup table;
receiving sensor measurement data;
applying said sensor measurement data to said lookup table, wherein said
applying said sensor measurement data to said lookup table includes updating
said Kalman filter in response to said sensor measurement data;
receiving a constraint on said table element values;
receiving an output request;
storing a duplicate copy of said Kalman filter in response to said receiving an
output request;
applying said constraint to said lookup table in response to said receiving an
output request and to said storing, wherein said applying said constraint to said
lookup table includes updating said Kalman filter in response to said constraint;
outputting a lookup table element in response to said applying said constraint
and to said output request; and
replacing said Kalman filter with said duplicate copy of said Kalman filter in
response to said outputting.

[c2]   2. The method of claim 1 wherein said output request is received from a gas
turbine engine diagnostics application.

[c3]   3. The method of claim 1 wherein said output request is received from a gas
turbine engine steam leak detection application.

[c4]   4. The method of claim 1 wherein said output request includes a request for
said lookup table and wherein said outputting includes outputting said lookup
table including said table element values.

[c5]   5. The method of claim 1 wherein said lookup table is one dimensional.

[c6]   6. The method of claim 1 wherein said lookup table is two dimensional.

[c7]   7. The method of claim 1 wherein said lookup table is three dimensional.

[c8]   8. The method of claim 1 wherein said constraint imposes a limit on slope of said table element values.

[c9]   9. The method of claim 1 wherein said constraint imposes a limit on curvature of said table element values.

[c10]   10. The method of claim 1 wherein said sensor measurement data includes a delta temperature variable.

[c11]   11. The method of claim 1 wherein said sensor measurement data includes a pressure ratio variable.

[c12]   12. The method of claim 1 wherein said sensor measurement data includes an effective area of the flowpath variable.

[c13]   13. A method for building a calibration lookup table, said method comprising:
            initializing said lookup table including initializing a Kalman filter corresponding to said lookup table wherein said Kalman filter includes state estimates corresponding to table element values in said lookup table;
            receiving a constraint on said table element values;
            applying said constraint to said lookup table, wherein said applying said constraint to said lookup table includes updating said Kalman filter in response to said constraint;
            receiving sensor measurement data; and
            applying said sensor measurement data to said lookup table, wherein said applying said sensor measurement data to said lookup table includes updating said Kalman filter in response to said sensor measurement data.

[c14]   14. The method of claim 13 further comprising:
            receiving an output request; and
            outputting a lookup table element in response to said output request.

[c15]   15. The method of claim 14 wherein said output request is received from a gas turbine engine diagnostics application.

[c16]
            16. The method of claim 14 wherein said output request is received from a gas

turbine engine steam leak detection application.

[c17]   17. The method of claim 14 wherein said output request includes a request for
said lookup table and wherein said outputting includes outputting said lookup
table including said table element values.

[c18]   18. The method of claim 13 wherein said constraint imposes a limit on slope of
said table element values.

[c19]   19. The method of claim 13 wherein said constraint imposes a limit on
curvature of said table element values.

[c20]   20. A system for building calibration lookup tables, the system comprising:
a sensor attached to a machine being diagnosed;
a host system in communication with said sensor, said host system including
software to implement the method comprising:
initializing said lookup table including initializing a Kalman filter corresponding
to said lookup table wherein said Kalman filter includes state estimates
corresponding to table element values in said lookup table;
receiving sensor measurement data;
applying said sensor measurement data to said lookup table, wherein said
applying said sensor measurement data to said lookup table includes updating
said Kalman filter in response to said sensor measurement data;
receiving a constraint on said table element values;
receiving an output request;
storing a duplicate copy of said Kalman filter in response to said receiving an
output request;
applying said constraint to said lookup table in response to said receiving an
output request and to said storing, wherein said applying said constraint to said
lookup table includes updating said Kalman filter in response to said constraint;
outputting a lookup table element in response to said applying said constraint
and to said output request; and
replacing said Kalman filter with said duplicate copy of said Kalman filter in
response to said outputting.

[c21] 21. The system of claim 20 wherein said machine being diagnosed is a gas turbine engine.

[c22] 22. The system of claim 20 further comprising a network, wherein said host system is in communication with said sensor via said network.

[c23] 23. The system of claim 22 wherein said network is the Internet.

[c24] 24. The system of claim 22 wherein said network is an intranet.

[c25] 25. A system for building calibration lookup tables, the system comprising:

a sensor attached to a machine being diagnosed;

a host system in communication with said sensor, said host system including software to implement the method comprising:

initializing said lookup table including initializing a Kalman filter corresponding to said lookup table wherein said Kalman filter includes state estimates corresponding to table element values in said lookup table;

receiving a constraint on said table element values;

applying said constraint to said lookup table, wherein said applying said constraint to said lookup table includes updating said Kalman filter in response to said constraint;

receiving sensor measurement data; and

applying said sensor measurement data to said lookup table, wherein said applying said sensor measurement data to said lookup table includes updating said Kalman filter in response to said sensor measurement data.

[c26] 26. The system of claim 25 wherein said machine being diagnosed is a gas turbine engine.

[c27] 27. The system of claim 25 further comprising a network, wherein said host system is in communication with said sensor via said network.

[c28] 28. The system of claim 27 wherein said network is the Internet.

[c29] 29. The system of claim 27 wherein said network is an intranet.

[c30] 30. A computer program product for building a calibration lookup table, the

product comprising:

a storage medium readable by a processing circuit and storing instructions for

execution by the processing circuit for performing a method comprising:

initializing said lookup table including initializing a Kalman filter corresponding

to said lookup table wherein said Kalman filter includes state estimates

corresponding to table element values in said lookup table;

receiving sensor measurement data;

applying said sensor measurement data to said lookup table, wherein said

applying said sensor measurement data to said lookup table includes updating

said Kalman filter in response to said sensor measurement data;

receiving a constraint on said table element values;

receiving an output request;

storing a duplicate copy of said Kalman filter in response to said receiving an

output request;

applying said constraint to said lookup table in response to said receiving an

output request and to said storing, wherein said applying said constraint to said

lookup table includes updating said Kalman filter in response to said constraint;

outputting a lookup table element in response to said applying said constraint

and to said output request; and

replacing said Kalman filter with said duplicate copy of said Kalman filter in

response to said outputting.

[c31]

31. A computer program product for building a calibration lookup table, the

product comprising:

a storage medium readable by a processing circuit and storing instructions for

execution by the processing circuit for performing a method comprising:

initializing said lookup table including initializing a Kalman filter corresponding

to said lookup table wherein said Kalman filter includes state estimates

corresponding to table element values in said lookup table;

receiving a constraint on said table element values;

applying said constraint to said lookup table, wherein said applying said

constraint to said lookup table includes updating said Kalman filter in response

to said constraint;

receiving sensor measurement data; and

applying said sensor measurement data to said lookup table, wherein said applying said sensor measurement data to said lookup table includes updating said Kalman filter in response to said sensor measurement data.